

REMARKS/ARGUMENTS

The Office Action mailed December 28, 2005 has been received and reviewed. Claims 1 through 33 are currently pending in the application. Claims 26-33 stand rejected. Claims 1-25 are allowed. Applicants have amended claims 26 and 29 and respectfully request reconsideration of the application as amended herein.

35 U.S.C. § 102(b) Anticipation Rejections

Anticipation Rejection Based on U.S. Patent No. 6,465,352 to Aoki et al.

Claims 26, 27, 31, and 32 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Aoki et al. (U.S. Patent No. 6,465,352). Applicants respectfully traverse this rejection, as hereinafter set forth.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Applicants assert that independent claims 26, 31, and 32 are not anticipated by Aoki et al. because Aoki et al. does not expressly or inherently describe a metallic damascene structure that includes a metallic layer including “an at least partly **reversed oxidation injury**,” as recited in each of claims 26, 31, and 32.

Aoki et al. describes a method of removing a resist film and a deposition after a dry-etching is carried out using the resist film as a mask in a semiconductor device fabricating process. *Aoki et al.*, column 1, lines 8-11.

As shown in FIG. 7A, Aoki et al. describes a structure that includes copper film 3, a silicon nitride film 4, a hydrogen silsesquioxane (HSQ) film 5, and a resist film 6. *Id.*, column 8, lines 51-67. As shown in FIG. 7B, Aoki et al. describes dry-etching a through-hole 7 in the HSQ film 5 and the silicon nitride film 4 using an etching gas of mixed CHF₃ and Ar. *Id.*, column 9, lines 6-11. As seen in FIG. 7B, a portion of the copper film 3 is exposed in the through-hole 7. As also seen in FIG. 7B, an etching residue 8 and a resist surface hardened layer 9 on the resist film 6 are formed during formation of the through-hole 7. *Id.*, column 9, lines 11-15. Aoki et al.

describes treating the resist surface hardened layer 9 with a hydrogen/nitrogen plasma to convert the resist surface hardened layer 9 to a property-changed resist hardened layer 9A, which can be removed by a resist mover liquid. *Id.*, column 9, lines 16-33.

Applicants respectfully assert, however, that Aoki et al. does not describe an at least partly reversed oxidation injury in the copper film 3 because Aoki et al. does not describe an oxidation injury in the copper film 3, or that the copper film 3 has been or may be exposed to an oxidizing agent and subsequently to a reducing agent. On the contrary, Aoki et al. teaches that “in place of the prior art resist removal by the oxygen plasma ashing, the resist is removed by a combination of the hydrogen/nitrogen plasma treatment and the wet treatment using the resist remover liquid. As a result, the resist film and the deposits can be removed **while preventing the oxidation** of the copper film 3.” *Aoki et al.*, column 9, lines 58-64. Therefore, Aoki et al. clearly does not describe, teach, or suggest an at least partly reversed oxidation injury in a metallic layer.

The Examiner asserts at Page 3 of the outstanding Office Action that claims 26 and 31 are in “the form of product-by process claims.” Applicants have amended claim 26 and respectfully assert that neither of claims 26 and 31 is in a product-by-process form as submitted herein. Applicants respectfully assert that an at least partly reversed oxidation injury is a structurally identifiable element, which may be identified by the presence, location, and or orientation of grain boundaries between grains of material comprising an at least partly reversed oxidation injury and the adjacent grains of substrate material in which an oxidation injury was formed and then at least partly reversed. Therefore, the language “an at least partly reversed oxidation injury” as recited in claims 26 and 31 cannot be considered a product-by-process limitation. *See e.g., In re Garnero*, 412 F.2d 276, 162 USPQ 221 (CCPA 1969) (holding that the language “interbonded...by interfusion” should be interpreted as a structural limitation rather than a process limitation); *Hazani v. U.S. Int’l Trade Comm’n*, 126 F.3d 1473, 44 USPQ2d 1358 (Fed. Cir. 1997) (holding that claims to a semiconductor memory cell requiring that a conductive plate have a surface that was “chemically engraved” were not product-by-process claims).

As Aoki et al. does not expressly or inherently describe each of the limitations of any one of independent claims 26, 31, and 32, Applicants respectfully assert that each of independent claims 26, 31, and 32 is not anticipated by Aoki et al. and request that the Examiner withdraw the rejections of independent claims 26, 31, and 32 under 35 U.S.C. § 102(b).

Applicants additionally assert that dependent claim 27 is allowable because, among other reasons, claim 27 depends directly from independent claim 26, which is allowable.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 6,465,352 to Aoki et al. in view of U.S. Patent No. 6,424,042 to Kitani, and further in view of U.S. Patent Application No. U.S. 2002/0030215 to Oashi et al.

Claim 28 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Aoki et al. (U.S. Patent No. 6,465,352) in view of Kitani (U.S. Patent No. 6, 424,042), and further in view of Oashi et al. (U.S. Patent Application No. US 2002/0030215). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

The 35 U.S.C. § 103(a) obviousness rejection of claim 28 is improper because the cited prior art references, when combined, do not teach or suggest a metallic layer that includes “an at least partly **reversed oxidation injury**,” as recited in independent claim 26, from which claim 28 indirectly depends.

As previously discussed herein, Aoki et al. does not describe, teach, or suggest an at least partly reversed oxidation injury. The teachings of Kitani and Oashi et al. do not satisfy the deficiency.

Kitani teaches a method of forming a damascene structure in a semiconductor device. The damascene structure provides an interconnection between interconnection layers in the device. *Kitani*, column 3, lines 36-44. Certain features of the structure are configured to

minimize adverse effects associated with the “dishing” phenomenon. *See Id.*, column 4, line 54 – column 5, line 13. Kitani does not, however, teach or suggest an at least partly reversed oxidation injury as recited in claim 26, from which claim 28 indirectly depends.

Oashi et al. teaches a semiconductor device that includes an integrated circuit having copper wires and copper diffusion blocking means provided in a region surrounding a memory storage portion of the device. *Oashi et al.*, page 1, paragraph [0012] – page 2, paragraph [0013]. Oashi et al. does not, however, teach or suggest a damascene structure that includes an at least partly reversed oxidation injury in a metallic layer, as recited in claim 26, from which claim 28 indirectly depends.

As the cited prior art references, when combined, fail to teach or suggest each of the limitations of claim 26, from which 28 depends, Applicants respectfully assert that the invention of dependent claim 28 could not have been obvious to one of ordinary skill in the art at the time the invention was made, and request that the Examiner withdraw the rejection of dependent claim 28 under 35 U.S.C. § 103(a).

Obviousness Rejection Based on U.S. Patent No. 6,885,080 to Chen et al. in view of U.S. Patent Application No. 2002/0030215 Oashi et al.

Claims 29, 30, and 33 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen et al. (U.S. Patent No. 6,885,080) in view of Oashi et al. (U.S. Patent Application No. US 2002/0030215). Applicants respectfully traverse this rejection, as hereinafter set forth.

The 35 U.S.C. § 103(a) obviousness rejections of independent claims 29 and 33 are improper because the cited prior art references, when combined, do not teach or suggest a damascene structure comprising a metallic layer including “an at least partly **reversed oxidation injury**,” as recited in each of independent claims 29 and 33.

Chen et al. teaches a device having an integrated circuit that includes a dynamic random access memory (DRAM) array on the same substrate as a microprocessor core or other logic device. *Chen et al.*, column 1, lines 11-14. Chen et al. does not, however, teach or suggest a damascene structure that includes an at least partly reversed oxidation injury in a metallic layer, as recited in each of independent claims 29 and 33.

Oashi et al. teaches a semiconductor device that include an integrated circuit having copper wires and copper diffusion blocking means provided in a region surrounding a memory storage portion of the device. *Oashi et al.*, page 1, paragraph [0012] – page 2, paragraph [0013]. Oashi et al. does not, however, teach or suggest a damascene structure that includes an at least partly reversed oxidation injury in a metallic layer, as recited in each of independent claims 29 and 33.

The Examiner asserts at Page 5 of the outstanding Office Action that claims 29, 30, and 33 are in “the form of product-by process claims.” Applicants have amended claim 29 and respectfully assert that none of claims 29, 30, and 31 is in a product-by-process form as submitted herein. Applicants respectfully assert that an at least partly reversed oxidation injury is a structurally identifiable element, which may be identified by the presence, location, and or orientation of grain boundaries between grains of material comprising an at least partly reversed oxidation injury and the adjacent grains of substrate material in which an oxidation injury was formed and then at least partly reversed. Therefore, the language “an at least partly reversed oxidation injury” as recited in claims 29, 30, and 31 cannot be considered a product-by-process limitation. *See e.g., In re Garnero*, 412 F.2d 276, 162 USPQ 221 (CCPA 1969) (holding that the language “interbonded...by interfusion” should be interpreted as a structural limitation rather than a process limitation); *Hazani v. U.S. Int’l Trade Comm’n*, 126 F.3d 1473, 44 USPQ2d 1358 (Fed. Cir. 1997) (holding that claims to a semiconductor memory cell requiring that a conductive plate have a surface that was “chemically engraved” were not product-by-process claims).

As the cited prior art references, when combined, fail to teach or suggest each of the limitations of either of independent claims 29 and 33, Applicants respectfully assert that the inventions of independent claims 29 and 33 could not have been obvious to one of ordinary skill in the art at the time the inventions were made, and request that the Examiner withdraw the rejections of independent claims 29 and 33 under 35 U.S.C. § 103(a).

Regarding dependent claim 30, the nonobviousness of independent claim 29 precludes a rejection of claim 30, which depends therefrom, because a dependent claim is obvious only if the independent claim from which it depends is obvious. *See, In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988), *see also*, MPEP § 2143.03. Therefore, the Applicants request that the Examiner

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withdraw the 35 U.S.C. § 103(a) obviousness rejections to independent claim 29 and to claim 30, which depends therefrom.

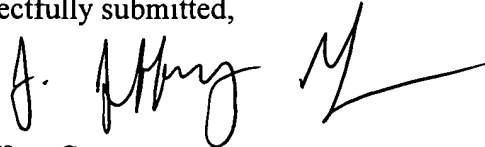
ENTRY OF AMENDMENTS

The amendments to claims 26 and 29 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application.

CONCLUSION

Claims 1 through 33 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,



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